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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/726,351 | 12/02/2003 | Herbert O. Ledeborn | 19680-008100US | 9024 |

20350 7590 12/02/2005

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| EXAMINER |
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ZAMAN, FAISAL M

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| ART UNIT | PAPER NUMBER |
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2112

DATE MAILED: 12/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------|---|--|
| Office Action Summary | Application No. 10/726,351 | Applicant(s) LEDEBOHM, HERBERT O. | |
| | Examiner Faisal Zaman | Art Unit 2112 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8-19 and 21 is/are rejected.
- 7) ☒ Claim(s) 7 and 20 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: --SERVICING OF MULTIPLE INTERRUPTS USING A DEFERRED PROCEDURE CALL IN A MULTIPROCESSOR SUBSYSTEM--.

Claim Objections

2. Claims 2, 3, and 4 are objected to because of the following informalities: there is a lack of consistent terminology, where the term "processors" is used in place of "co-processors".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. **Claims 1-6 and 8** are rejected under 35 U.S.C. 102(e) as being anticipated by Diamant (U.S. Patent Publication No. 2004/0122997).

Art Unit: 2112

Regarding Claim 1, Diamant discloses a method for servicing interrupts by a plurality of co-processors in a multiprocessor subsystem (Figure 1, items 10a - 10n, Page 2, paragraph 20, the devices in Diamant are considered equivalent to the co-processors of the current application because both perform the function of processing data in the computing system), the method comprising the acts of:

In response to a detected interrupt, determining whether the detected interrupt was generated by one of the plurality of co-processors of the multiprocessor subsystem (Page 4, paragraph 40); and

In the event that the detected interrupt was generated by one of the plurality of co-processors, scheduling execution of a deferred servicing procedure (Page 4, paragraph 41);

Wherein during execution the deferred servicing procedure services a plurality of pending interrupts generated by one or more of the plurality of co-processors, including the detected interrupt (Page 5, paragraph 43).

Regarding Claim 2, Diamant discloses wherein during execution the deferred servicing procedure services all pending interrupts from all of the plurality of processors (Figure 3, Page 6, Claim 5).

Regarding Claim 3, Diamant discloses wherein the plurality of pending interrupts serviced by the deferred servicing procedure includes a second interrupt generated by the one of the plurality of processors that generated the

Art Unit: 2112

detected interrupt (Figure 9, Page 5, paragraph 43, since there is a continuous loop that checks to see if another interrupt was generated from the device, it is understood that a second interrupt from the device could be serviced during the same deferred servicing procedure).

Regarding Claim 4, Diamant discloses wherein the plurality of pending interrupts serviced by the deferred servicing procedure includes a second interrupt generated by one of the plurality of processors other than the one that generated the detected interrupt (Figure 3, Page 6, Claim 5, since there is a continuous loop that checks to see if another interrupt was generated from the devices in the multiprocessor system, it is understood that a second interrupt from one of the devices could be serviced during the same deferred servicing procedure).

Regarding Claim 5, Diamant discloses wherein the act of determining whether the detected interrupt was generated by one of the plurality of co-processors includes the acts of:

Selecting one of the plurality of co-processors as a current co-processor (Figure 8, Page 4, paragraph 40, the device which sends the interrupt begins the loop shown in Figure 8 and is therefore the current device); and

Reading a value stored in an interrupt register of the current co-processor (Figure 1, items 14a – 14n, Page 2, paragraph 25).

Art Unit: 2112

Regarding Claim 6, Diamant discloses wherein the event that the value stored in the interrupt register does not indicate an interrupt, a different one of the co-processors is selected and the act of reading is repeated (Figure 6, Page 4, paragraph 37).

Regarding Claim 8, Diamant discloses the method of claim 1 further comprising the act of disabling further interrupts from the plurality of co-processors in the event that the detected interrupt was generated by one of the plurality of co-processors (Page 1, paragraph 7),

Wherein during execution the deferred servicing procedure re-enables interrupts from the plurality of co-processors (Figure 9, item 408, Pages 4-5, paragraph 42).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. **Claims 9-19 and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Diamant in view of Simpson (U.S. Patent No. 5,867,687).

Diamant discloses the invention substantially as claimed.

Regarding Claim 9, Diamant discloses the act of disabling further interrupts (Diamant, Page 1, paragraph 7).

Diamant, however, does not disclose expressly wherein the act of disabling further interrupts is performed at a critical priority level.

In the same field of endeavor (e.g. control of multiple priority level interrupt requests to a CPU of a microprocessor), Simpson discloses a method for handling interrupts based on multiple priority levels (Column 1 line 40 – Column 2 line 7).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have combined the Simpson's teachings of control of multiple priority level interrupt requests to a CPU of a microprocessor with the teachings of Diamant, for the purpose of handling multiple priority level interrupt requests to a processor while reducing the problem of alteration to the processor itself (see Simpson, Column 1, lines 36-39). Also, it would have been desirable as stated by Simpson for interrupt processes to be able to be interrupted by higher priority interrupt processes (see Simpson, Column 2, lines 1-2). Diamant provides motivation to combine by stating there is a need in the art to provide improved techniques for handling device interrupt requests (see Diamant, Page 1, paragraph 8).

Regarding Claim 10, Diamant discloses the act of determining whether the detected interrupt was generated by one of the plurality of co-processors (Diamant, Page 4, paragraph 40).

Art Unit: 2112

Diamant, however, does not disclose expressly wherein the act of determining whether the detected interrupt was generated by one of the plurality of co-processors is performed at a critical priority level.

In the same field of endeavor, Simpson discloses a method for handling interrupts based on multiple priority levels (Column 1 line 40 – Column 2 line 7).

The motivation that was utilized in the combination of Claim 9, super, applies equally as well to Claim 10.

Regarding Claim 11, Diamant discloses the act of scheduling execution of the deferred servicing procedure (Page 4, paragraph 41).

Diamant, however, does not disclose expressly wherein the act of scheduling execution of a deferred servicing procedure is performed at a critical priority level.

In the same field of endeavor, Simpson discloses a method for scheduling execution and deferring interrupts based on multiple priority levels (Column 1, lines 40-61).

The motivation that was utilized in the combination of Claim 9, super, applies equally as well to Claim 11.

Regarding Claim 12, Diamant discloses the act of scheduling execution of a deferred servicing procedure (Page 4, paragraph 41).

Diamant, however, does not disclose expressly wherein the act of scheduling execution of a deferred servicing procedure includes setting a second

Art Unit: 2112

priority level for the deferred servicing procedure, wherein the second priority level is lower than the critical priority level.

In the same field of endeavor, Simpson discloses a method for scheduling execution and deferring interrupts based on multiple priority levels (Column 1, lines 40-61).

The motivation that was utilized in the combination of Claim 9, super, applies equally as well to Claim 12.

Regarding Claim 13, Diamant does not disclose expressly wherein the multiprocessor subsystem is a graphics processing subsystem, however the Examiner takes official notice that the use of interrupts in a graphics processing subsystem is well known in the art, as evidenced by Wilt et al. (abstract), cited below under Prior Art of Record, to facilitate efficient execution of multiple applications in a multitasking environment.

Claims 14-19 are directed to a computer system of the method of claims 1-6 and 8-12, and **Claim 21** is directed to an article comprising a computer readable medium of the method of claims 1-6 and 8-12. Diamant and Simpson teach, either alone or in combination as stated above, the method as set forth in Claims 1-6 and 8-12. Therefore, Diamant and Simpson also teach, either alone or in combination as stated above, a computer system comprising the multiprocessor subsystem as set forth in Claims 14-19. Further, Diamant and

Art Unit: 2112

Simpson teach, either alone or in combination as stated above, an article comprising a computer readable medium as set forth in Claim 21.

Allowable Subject Matter

7. **Claims 7 and 20** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Prior Art of Record

8. U.S. Patent Publication No. 2003/0140179 to Wilts et al. is cited as relevant art.

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kennedy et al. (U.S. Patent No. 5,446,910) discloses an interrupt controller with automatic distribution of interrupts for a multiple processor computer system. Goodman et al. (U.S. Patent No. 6,282,601) discloses a multiprocessor data processing system and method of interrupt handling that facilitate identification of a processor requesting a system management interrupt. Comeau et al. (U.S. Patent Publication No. 2002/0161957) discloses methods and systems for handling interrupts. Gaur et al. (U.S. Patent Publication No. 2002/0144004) discloses a driver having multiple deferred procedure calls for interrupt processing and a method for interrupt processing. Stevens (U.S. Patent Publication No. 2003/0101293) discloses a deferred procedure call in interface description language. Casano et al. (U.S.

Art Unit: 2112

Patent No. 6,571,206) discloses an apparatus and method for emulating an I/O instruction for the correct processor and for servicing software SMI's in a multiprocessor environment. Kaniyar et al. (U.S. Patent Publication No. 2003/0187914) discloses symmetrical multiprocessing in multiprocessor systems. Connor et al. (U.S. Patent Publication No. 2004/0111549) discloses a method, system, and program for improved interrupt processing. Asselin (U.S. Patent No. 6,772,189) discloses a method and system for balancing deferred procedure queues in multiprocessor computer systems. Rankin et al. (U.S. Patent No. 6,813,665) discloses an interrupt method, system, and medium which helps balance servicing of interrupts among processors.

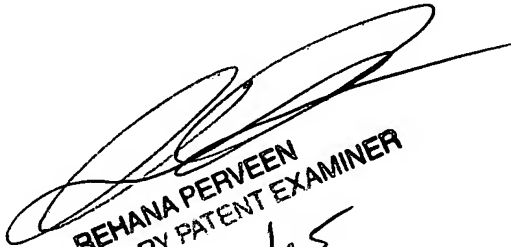
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Faisal Zaman whose telephone number is 571-272-6459. The examiner can normally be reached on Monday thru Friday, 9 am - 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rehana Perveen can be reached on 571-272-3676. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2112

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

fmz



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11/23/05